

THE PHILOSOPHY OF A BIOLOGIST.

Éléments de Philosophie biologique. By Félix le Dantec. Pp. iii+297. (Paris: F. Alcan, 1907.)

PROGRESS in knowledge takes place by the discovery of facts, and by drawing inferences from the facts discovered. It is commonly supposed that the facts existed before we discovered them; and this hypothesis stands the test of practical utility. But it is not supposed, except by the most careless thinkers, that the inferences which we draw from the facts—our laws and principles—are anything more than conceptual summaries of the facts and sequences of facts within our ken. (We use the word fact, not because in current usage it means that about which there can be no doubt, but because it includes a wider range of phenomena than the word "thing.") The fact that 25 per cent. of the peas, produced by breeding from hybrids resulting from the union of a yellow and a green pea, are green can hardly be described as a "thing.") Our inferences may be right or they may be wrong, but they did not exist before we made them. Whether we can draw any sharp distinction between fact and inference; or, to put it in terms of space, whether we can draw a line of demarcation and say where fact ends and where inference begins, is a question which concerns the modern biologist perhaps more vitally than any other; yet it is one which very few have definitely formulated, much less attempted to answer. The cause of the almost universal failure to provide a satisfactory answer is a habit of the mind, encouraged by text-books of logic, which drives it to classify things, often dichotomously, into two mutually exclusive categories. Music affords an example. Some folk hold that the music of certain authors is good, whilst that of others is bad. Others, however, say that taste is a purely relative matter, and that no one has a right to say that the music of a given author is good, or bad, as the case may be.

The real truth is that whilst at one pole there are classes of music which are unquestionably good, that at the other there are types which are equally unquestionably bad; between the two there is a series of intermediate kinds about which it is debatable whether they are good or bad.

It is the same with fact and inference. At one pole there are undoubtedly things which can be classed as facts; at the other, things which cannot be claimed to be more than inference. But between the two there is a whole range of things which some regard as facts, whilst others regard them not only as inferences, but as unwarrantable ones. Biologists are far too much occupied with discovering facts and with drawing inferences to stop to consider the relation between these two processes. It is therefore with particular pleasure that we note the appearance of Prof. le Dantec's book, "Éléments de Philosophie biologique," at the present moment.

The book is divided into two main divisions, of which the first embraces the methods and the second the facts—an arrangement which, at first sight, appears natural, but which, on closer inspection, in our

opinion loses this feature. It seems, at first glance, natural that we should first describe the method of quarrying slate, and then dilate on the properties of the material brought to the surface by the machinery we have described. But in our opinion a truer picture of nature is conveyed by displaying the profusion and chaos of her phenomena first, and then tentatively enunciating the general conclusions we have ventured to draw from them afterwards. When we look closer at that part of Prof. le Dantec's book which deals with method, the temporary illusion of naturalness of arrangement completely vanishes; for an array of possibly true but extremely abstruse generalisations meets our eyes. The first chapter deals with the conceptions of "unity" and "diversity," which are surely not part of the equipment by means of which facts are brought to light, but some of the fruits which their discovery has borne.

But we do not wish to convey the impression that in our opinion the book is not a valuable one. It contains some much needed caution on the dangers of an unconscious anthropomorphism in the interpretation of nature, and on the dangers of, what is merely a result of that fallacy, a too premature attempt to analyse phenomena. But perhaps what makes the book more valuable than anything else is Prof. le Dantec's familiarity with the facts with which the science of pathology deals, a range of phenomena which more directly concerns, but is perhaps less heeded by, the student of evolution than any other.

THE HAMBURG EXPEDITION TO SOUTHWESTERN AUSTRALIA.

Die Fauna Südwest-Australiens. Ergebnisse der Hamburger südwest-australischen Forschungsreise, 1905. Edited by Prof. W. Michaelsen and Dr. R. Hartmeyer. Vol. i., part i. Reisebericht by Prof. W. Michaelsen and Dr. R. Hartmeyer. Pp. viii+116; illustrated. (Jena: Gustav Fischer, 1907.) Price 4 marks.

THE zoological collections of the German South Polar Expedition to South Georgia in 1882-83 are preserved in the Natural History Museum at Hamburg, the staff of which therefrom acquired a special interest in the subantarctic fauna. On the renewal of Antarctic research, the Hamburg zoologists decided they could contribute most usefully to that work by continuing the investigation of the adjacent regions. The marine subantarctic fauna is most accessible on the western coasts of the three great southern continents, where its range is extended northward by cold ocean currents. The Hamburg Museum accordingly arranged zoological expeditions to each of these three areas. The first went to South America, and worked in the Straits of Magellan and along the western coasts of Chilian Patagonia; its collections have been described in a series of monographs issued from 1896 to 1907. The second expedition was led by Dr. Schultze to the coasts of south-western Africa, and the series was completed by the visit of Prof. Michaelsen and Dr. Hartmeyer to Westralia from June to October, 1905. They there made marine collections

in Shark's Bay, Champion Bay, Geographe Bay, and King George's Sound; they collected on land, especially around Perth, Geraldton, and Albany, and travelled inland as far eastward as Kalgoorlie. They describe the south-western part of Australia as zoologically "a forgotten corner," for as Westralia is younger and larger and has a smaller population than the Eastern States, it has not been able to organise such extensive studies of its fauna and flora.

The authors regard their expedition as very successful, and their scientific results are to be issued in a series of volumes, of which the part now published is only the general introduction. It describes the authors' journey, and gives a list, with a map of their collecting stations. It consists of two reports, one by Prof. Michaelsen, describing his general observations on the geography of Westralia, including its scenery, physiography, flora and fauna, and the aborigines. Dr. Hartmeyer contributes an account of the sheep-farming, the mining industry at Kalgoorlie, and of the dredging expeditions. Both essays give a pleasant account of the country in spite of sufferings from the ubiquitous Worcester sauce. They gratefully acknowledge the ready help of the officials and people. They remark the "extravagant" width of the Kalgoorlie streets, and the difficulties of railway administration on lines where, as Prof. Michaelsen expresses it, there is no fear of collisions. Their Shark's Bay boatman seems to be a typical Australian; "he speaks not much, but he understands his business, and what he does he does with hand and foot." The report contains interesting comparisons with other faunas. Thus Prof. Michaelsen, who had previously studied the zoology of Lake Baikal, contrasts the fauna of that very ancient, perhaps pre-Devonian, deep lake, with the life of the recent, shallow pools of Western Australia.

The most generally interesting zoological result given is probably Prof. Michaelsen's conclusion as to the relations of eastern and western Australia as indicated by the earthworms (pp. 49-50). He holds that since the appearance of the ancient genus *Plutellus*, south-western Australia has been united by land only to the eastern States. There are no affinities to other lands, which are not also common to eastern Australia. Comparatively few foreign earthworms entered eastern Australia, and they arrived at different dates, and crossed subsequently into south-western Australia. There they developed into distinct though closely allied species, probably at a time when the land extended farther south-westward in separate peninsulas or had been temporarily divided into islands, which gave the worms on them complete though temporary isolation.

As the authors' journey was naturally confined to the best known areas in Westralia, there was not much opportunity for obtaining new geographical information, and the value of the work of the expedition will depend on the technical and biological memoirs which are to follow. This preliminary account gives evidence of such thorough and careful work, that important results may be expected from the work of two such skilled zoological experts.

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OUR BOOK SHELF.

Experimental and Theoretical Applications of Thermodynamics to Chemistry. By Dr. Walther Nernst. Pp. x+123. (London: A. Constable and Co., Ltd., 1907.) Price 5s. net.

Technische Anwendungen der physikalischen Chemie. By Dr. Kurt Arndt. Pp. vii+304. (Berlin: Mayer and Müller, 1907.) Price 7 marks.

The first of the above volumes contains a series of ten lectures delivered by Prof. Nernst at the Yale University in 1906 under the Silliman Foundation. After two introductory chapters, a *résumé* is given of the experimental investigations which have been carried out by the author and his students on chemical equilibria at high temperatures. In a theoretical discussion of the results, the author develops the view that relationships exist between chemical energy and heat other than those expressed by the first and second laws of thermodynamics. From a consideration of the conditions under which the principle of Berthelot comes nearest to expressing the true relation between heat and chemical energy, the conclusion is drawn that the total and free energies are not only exactly equal at absolute zero, but that their values coincide completely in the vicinity of this temperature. In the last three chapters the practical application of the integrated equation of the reaction isochore is illustrated by calculation of the equilibrium in various dissociating systems at high temperatures, such as water vapour, nitric oxide, hydrogen chloride, carbon dioxide, and metal ammonia compounds.

Whether the reader is interested in the fundamental theoretical speculations or the practical application of the derived formulæ, Prof. Nernst's series of lectures cannot be too warmly recommended.

In his "Technische Anwendungen" Dr. Arndt presents an account of certain chapters of physical chemistry and of recent investigations which have an important bearing upon technical processes. The volume does not make any pretence to be a complete treatise on the subject, but carefully chosen examples of the application of physico-chemical principles to industrial processes are discussed in considerable detail. In the first three chapters the formation of nitric oxide from air, the equilibrium in the manufacture of generator and water gas, the manufacture of sulphuric acid by the contact process, the formation of ammonia and of ozone are dealt with, the remaining ten chapters being devoted to a less detailed consideration of catalysts, changes of state, solutions, alloys, dissociation pressures, and the measurement of high temperatures.

The book is distinctly worthy of attention, has many good features, and contains a lot of useful references, although the author—if one may judge from the very small number of references to English chemical literature—does not appear to be very familiar with work carried out in this country. This is an unfortunate circumstance, and detracts not a little from the value of the book.

H. M. D.

Die Ausgleichsrechnung nach der Methode der kleinsten Quadrate. By F. R. Helmert. Second edition. Pp. xviii+578. (Leipzig and Berlin: B. G. Teubner, 1907.) Price 16 marks.

The principal changes in this new edition consist in the more detailed discussion of errors of observation, instrumental corrections, interpolation problems, and the reduction of triangulations. The last chapter deals with the choice of favourable conditions in various surveying problems. In its present form the work appears to be admirably suited for those who have to make practical use of the theory of errors, especially